Rhodora

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RHODORA.—**A monthly journal of botany, devoted primarily to the flora of New England. Price, $2.00 per year, postpaid (domestic and foreign); single copies (if available) 20 cents. Volumes 1-8 or single numbers from them can be supplied at somewhat advanced prices which will be furnished on application. Notes and short scientific papers, relating directly or indirectly to the plants of the northeastern states, will be gladly received and published to the extent that the limited space of the journal permits. Forms will be closed five weeks in advance of publication. Authors (of more than one page of print) will receive 25 copies of the issue in which their contributions appear. Extracted reprints, if ordered in advance, will be furnished at cost.**

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THE GENUS ELODEA IN NEW ENGLAND.

HAROLD ST. JOHN.

MANY New England botanists have recently realized that *Elodea*, as represented in their region, was not one uniform species, *E. canadensis* Michx, as it had so long been considered. The credit for this renewal of interest in the genus should, in large part, go to Dr. P. A. Rydberg, who perceived the fundamental importance of the floral differences, correlated them with the leaf characters, and gave us our first comprehensive treatment[1] that even approximated the true taxonomic relationships.

Adherents of the International Rules, however, cannot follow Rydberg in adopting Rafinesque's name *Philotria*,[2] since *Elodea* of Michaux is the first published name for the genus. The earlier name *Elodes* of Adanson[3] for what is now considered a section of *Hypericum*, would not under the International Rules invalidate *Elodea* of Michaux, even if the former were still maintained as of generic rank.

The reason for the imperfect understanding of this genus is, of course, the fact that the best characters are to be found in the flowers, which are so evanescent that they may be found on only a few days out of the year. Sterile material can be identified with reasonable surety, but only after one has determined the specific limits by the study of flowering material.

Michaux when founding the genus described[4] his *Elodea canadensis* as with perfect flowers, having the floral tube prolonged into a long

[1] Rydberg, P. A., Notes on Philotria Raf. Bull. Torr. Bot. Cl. xxxv. 457–65 (1908).

[2] Rafinesque, C. S., Review of Pursh's Flora of North America. Am. Monthly Mag. ii. 175 (1818).

[3] Adanson, M., Fam. des Pl. ii. 444 (1763).

[4] Michaux, A., Fl. Bor.-Am. i. 20 (1803).

thread, sheathed at base with a long spathe, the ovary sessile, the style elongate, the 3 stigmas two-parted, the 3 stamens cordate, borne on thick filaments opposite the outer of the 6 perianth lobes, and the leaves in whorls of 3, oblong and obtusish. According to Caspary it appears from the data with the specimens that they were found near Montreal, while the published statement is brooks of Canada ("in rivulis Canadae"). There are six specimens, two of them with flowers.

By some unknown agency this species was introduced into Europe where it was found at Warringstown, Ireland,[1] in 1836 by a gardener, John New. In 1842 it appeared in the lake of Dunse Castle, Berwickshire, Scotland, and near Dublin, Ireland; in 1847 in the Foxton Locks near Market Harborough, Leicestershire, and at Chichester, Hampshire, England. This strange exotic was cultivated in the botanical gardens on the continent, and it soon spread to the adjacent rivers and canals and now is one of the commonest hydrophytes of western Europe. It is now commonly known in England as American duckweed, riverweed, waterweed, Babington's curse, water thyme, choke pondweed; in Ireland as cat's tails; in France as élodée du Canada; in Germany as Wasserpest, kanadische Wasserpest; in Holland as waterpest, engelsch ruigt, professerskruid, studentenroet; in Denmark as Vandpest; in Sweden as Vattenpest; and in Italy as peste d'acqua. Most of these names have an uncomplimentary connotation, the plant being either a weed or a pest. It is difficult for a botanist who has searched for this water plant in New England, and perhaps succeeded a few times in finding it in the western parts of Vermont, Massachusetts, or Connecticut, to think of it as a serious water pest. It is uncommon or local, and certainly not a troublesome weed, but when introduced into Europe it spread like wild fire and became a serious menace to drainage and navigation through choking up the rivers and canals. Two well authenticated cases are quoted to illustrate this. "In 1847 a specimen[2] from the Foxton Locks was planted in a tub, in the Cambridge Botanical Garden; and in 1848 the late Mr. Murray, the Curator, placed a piece of it in the conduit stream that passes by the new garden. In the follow-

[1] Horn, P., Ueber die sogenannte "Wasserpest" (Elodea canadensis Casp.). Archiv der Pharmacie (or Deutscher Apotheker-Verein) 3rd ser. i. 51–68 (1872); Zur Entwicklungsgeschichte der Blüthe von Elodea canadensis 426–433 (1872).

[2] Marshall, W., Excessive and noxious Increase of Udora Canadensis (Anacharis Alsinastrum). Phytologist iv. 714 (1851).

ing year, on Mr. Babington asking what had become of the stick which marked the site of the plant, he was informed that it had spread all over the ditch. From this point it doubtless escaped, by the waste pipe, across the Trumpington Road into the 'Vicar's Brook,' and thence into the river above the mills, where it is now found in the greatest profusion. In the case of the Cam, then, we see it proved to demonstration, that the short space of four years has been sufficient for one small piece of the Anacharis to multiply so as to impede both navigation and drainage. When Professor Gray, of Boston, U. S., was at Cambridge, Mr. Babington mentioned the circumstances to him, at which he expressed surprise, as the Anacharis is not found to spread in this active manner in America. Perhaps our sluggish streams, the decomposing vegetable and animal matters in our Cambridge waters, and especially the excess of lime present (fifteen to seventeen grains in the gallon), furnishing an inexhaustible supply of inorganic food, may account for its more rapid increase here than in America."

It is noteworthy that with the exception of two stations in eastern Massachusetts, Lake Quannapowitt, Wakefield, Andover, and a third near Providence, Rhode Island, we know the true *Elodea canadensis* in New England only from western Vermont, Berkshire County, Massachusetts, and western Connecticut, regions abounding in limestone strata. Marshall's suggestion that the limy nature of the waters in England may be the factor so favorable for its rapid growth and dispersal, receives interesting confirmation from the rarity of *Elodea canadensis* in America in regions that are not decidedly limy.

"The American weed[1] (*Anacharis Alsinastrum*) is causing a great amount of anxiety here on account of its amazing growth, and the tenacity with which it clings to those spots where it once takes possession. There is a beautiful sheet of water, of about eighty acres, through which the river Trent passed previous to the year 1853, when its channel was diverted, but there are still places where the connection is maintained, although but slightly so. About three years ago the *Anacharis* first made its appearance in the river, a short distance above the lake; it had previously taken possession of the Trent and Mersey Canal, with which there are means of communication, and a month afterwards it was visible in the lake. Both

[1] Marshall, W., The American Water-Weed. Phytologist n. s. ii. 195 (1857–8).

last year and the previous one it had increased so rapidly as to require removal by manual labour: *but the more it was disturbed the faster it grew.* This year it covers the entire surface, and *in so dense and wonderful a manner that no amount of labour seems capable of removing it, or even keeping it under. It actually grows faster than it can be cleared off,* the mode of which is, first by cutting, and then by drawing it together by means of long rafts, collecting it on the shore, and either carting it away or placing it in heaps for decomposition."

In 1848, after this strange new waterweed had been found several times and sent to him twice, Babington[1] described it as *Anacharis Alsinastrum.* It has been stated repeatedly that this plant produces in Europe only pistillate flowers. In America it is said to produce perfect flowers. Babington, however, states that the female flowers have three subulate filaments, lacking anthers. Marshall[2] says, "it flowers in our still waters in the greatest profusion, covering the surface with its tiny blush-colored flowers and silky threads, but I have never found any but females. From the peculiar character of the female flower (by which I mean the fact that although there are no *perfect* stamens present, yet *the filaments* are always there, wanting only anthers to surmount them to make the flowers perfectly hermaphrodite), * * *." These flowers have been figured in European works, and their plan is 3 sepals, 3 petals, 3 bipartite stigmas, and 3 filaments or staminodia. See, for instance, the beautiful plate in the English Botany.[3] The American literature is full of references to the staminate flowers of *Elodea canadensis,* but it seems clear now, that in every case this was due to a confusion with some one of the other species of *Elodea,* all of which do have distinct staminate flowers. It is true that Caspary identified with Michaux's material of *Elodea canadensis* some specimens from Bethlehem, Pennsylvania, *C. J. Moser,* 1832, which he says have 7 stamens and no stigmata. The writer feels confident that these specimens of Moser's belong to another species. To summarize, as *Elodea canadensis* Michx. occurs in Europe it produces pistillate flowers with 3 filaments or staminodia. All flowering material from America examined by the writer has exactly the same sort of flowers, pistillate flowers with 3 staminodia.

[1] Ann. & Mag. Nat. Hist. II. i. 83 (1848); translated in Ann. Sci. Nat. Bot. 3rd ser. xi. 69 (1849).

[2] Phytologist n. s. ii. 196 (1857–8).

[3] Smith, J. E. & Sowerby, English Bot. Supplement pl. 2993 (1865).

Through the careful observations of several workers we now know that the other North American species have one type of flowers identical in structure with the only type produced by *E. canadensis* Michx., that is pistillate flowers bearing 3 staminodia. This was demonstrated for the species *occidentalis* by R. W. Woodward,[1] for *Nuttallii* by Nuttall,[2] and for *Planchonii* by Wylie.[3] Thus in the structure of its floral parts *E. canadensis* stands apart from these other species only in its total lack of any distinct staminate flowers. We have only Michaux's statement that his plant had three terminal cordate anthers borne on thick filaments ("TRIANDRIA * * * filamenta crassa: antherae terminales, cordatae"). This leaves us with a question that can only be settled by field work in the streams and ponds of the limy regions from Quebec to the mountains of Virginia, westward to Minnesota and southern Saskatchewan. Does *Elodea canadensis* ever produce perfect flowers, or are they always pistillate flowers with 3 filaments or staminodia?

In 1814, Pursh described[4] a *Serpicula occidentalis*. He bases this in part on *Elodea canadensis* Michx., quoting Michaux's name as a synonym and giving the reference to Michaux's Flora. In the description there is an element that tallies exactly with *Elodea canadensis* as described by Michaux from the rivers of Canada: the flowers being perfect, with three stamens, with strap-shaped reflexed biparted stigmas. But, to this Pursh adds, "foliis ternatis linearibus acutis. * * * In stagnant waters, frequent; from Canada to Virginia. 2l. July. *v.v.* * * *. Michaux describes the leaves to be oblong and obtuse, which is only the case in the early part of the season: at flowering time they certainly are long, linear, and acute." It will be apparent that Pursh had himself seen a species of this genus, probably in Virginia, one which even at flowering time had long linear acute leaves. There is such a species, and it is easily distinguished from *Elodea canadensis* Michx. on these vegetative characters, as well as floral characters which Pursh does not mention, drawing his description of the floral parts from Michaux and his *E. canadensis*. This linear-leaved species has a more southerly range, not being known from Canada. It occurs in southern Maine,

[1] Rhodora xxi. 219 (1919).
[2] Nuttall, Thomas, Gen. N. Am. Pl. ii. 242 (1818).
[3] Iowa State Univ. Nat. Hist. Bull. vi. 49 (1913).
[4] Pursh, Frederick, Fl. Am. Sept. i. 33 (1814).

eastern Vermont, eastern Massachusetts including Essex, Middlesex, Suffolk, Norfolk and Barnstable Counties, Rhode Island, eastern and central Connecticut, Long Island, New York City, regions of the lower Delaware River, lower Susquehanna River, Chesapeake Bay, and westward to Wisconsin, Missouri, Nebraska, and in Oregon. In most of these regions the soil is derived from granitic or sandy sources, and the element of lime is conspicuous by its absence. To this species Pursh's name *occidentalis*, excluding the synonym *Elodea canadensis* Michx. and the part of the description drawn from it, is applicable, and as it is the first name for it within the specific category, the new combination is made here. The more northern *E. canadensis* is known to the writer from a station in the mountains of Virginia, and another in Kentucky, but these are the only stations south of southwestern Connecticut.

For this plant, in the eastern part of its range, Rydberg takes the name *Serpicula verticillata, B. angustifolia* Muhl.[1] and makes the specific combination. This varietal name *angustifolia* Muhl., although a nomen subnudum, seems to be properly applied to this plant, but if it is considered a species, as by Dr. Rydberg and the writer, the varietal name must be replaced by the first specific name, *occidentalis* Pursh, which was the first name in the proper category.

From this species Rydberg[2] distinguishes *Philotria minor* (Engelm.) Small which has similar staminate and pistillate flowers, but differs in having the "Leaves 5–8 mm. long; sepals and petals 1–1.5 mm. long" instead of "Leaves 1 cm. long or more; sepals and petals 1.5–2 mm. long" and growing in the central valley of the United States instead of in the northern Atlantic states. There is a good specimen of Engelmann's *Udora verticillata ? minor* from St. Louis, 1845, in the Gray Herbarium. This was first published[3] in synonomy under *Anacharis Nuttallii* Planchon. It was the basis of *Philotria minor* (Engelm.) Small.[4] There is no wide gap between the ranges of *occidentalis* and *minor* nor can the writer distinguish any differences in the flowers or leaves. Consequently *minor* is placed in the synonomy of *occidentalis*.

In an article on the "Morphology of Elodea canadensis," Robert B. Wylie[5] gives some important details of the phenomena of pollination.

[1] Muhlenberg, Henry, Cat. Pl. N. Am. 84 (1813).
[2] Bull. Torr. Bot. Cl. xxxv. 463–5 (1908).
[3] Pringsheim's Jahrb. wissen. Bot. i. 465 (1858).
[4] Small, J. K., Fl. S. E. U. S. 47 (1903).
[5] Wylie, Robert B., Bot. Gaz. xxxvii. 11 (1904).

It is clear from the context that his observations were made on the species here treated as *occidentalis*. "The staminate flowers are borne entirely beneath the surface of the water, and these, as is well known, break off and rise to the surface, there shedding the pollen. It is probable that with the ripening of the sporangia, in the still submerged flower, gases given off by the plant fill the spaces about the spores as well as any other cavities developed in the flower. At maturity a bubble of oxygen forms at the tip of the flower, and with its enlargement the sepals open slightly. At this time, looking down into the flower one can see that the sporangia have opened, and that many of the spores have been shed into the central space. The oxygen bubble may finally become nearly as large as the flower, and, when conditions are proper, the buoyancy of the enclosed gas, aided by the low specific gravity of the flower itself, overcomes the weakened attachment, and the flower darts to the surface. Upon reaching the surface the bubble disappears, the sepals snap back quickly, and in their recurved position form three boat-like floats which support the sporangia above the water; these catch the breeze and the flower sails away. While such float devices for the staminate flower are thought to be of great importance in the pollination of Vallisneria, it is doubtful if any significance can be attached to them in Elodea. The pollen was nearly all discharged at the moment the flower came to the surface, and any remaining portion would have no better opportunity for reaching the stigma of the pistillate flower. The snow-white tetrads are quite conspicuous floating on the water, or scudding along the surface with the wind.

The floating of the pollen grains is due to the nature of the outer spore coat. In a previous paragraph it was mentioned that the exine was covered with spines, each bearing at its tip a slight enlargement; these spines tend to hold back the surface film from contact with the body of the spore, and thus imprison enough air to keep it afloat. The microspore has a greater specific gravity than water, and will sink at once if wetted. * * *

While the gas bubbles may not be necessary for pollination, they are certainly very helpful. Their buoyancy aids in detaching the flowers, raises them quickly to the surface, and the sudden recurving of the sepals may be related in some way to the escape of the bubbles on reaching the air. The accumulation of gas about the spores of the submerged flower is also of significance in that it prevents the

moistening of the ripe spores while yet submerged; for this, as we have seen, would lead to their sinking or release. * * * *

The pistillate flower, as has been noted above, reaches the surface of the water by the lengthening of the fused parts above the ovary. * * * The floral parts * * * * are repellent to water and so resist wetting for many hours. With the opening of the flower the three prominent stigmas quickly recurve, arching well out over the floral envelopes. Lying thus, commonly on its side at first, the weight of the flowers rests chiefly on the stigmas. Since the stigmas are not readily wetted by water, they form a depression in the surface film. Pollen grains floating near the flower therefore approach and quickly slide down into contact with the stigma. There is thus established about each flower 'a circle of influence,' which in quiet waters is about 2 cm. in diameter, and spores floating into this area are immediately brought into contact with the stigma. * * * *

It will be seen that the whole process of pollination is dependent in one way or another upon the *surface film* of water."

Later this species was observed during two successive seasons by R. W. Woodward, and he gives a detailed, accurate description[1] of the gross morphology of the staminate and pistillate flowers, and comments on the mechanism of cross fertilization of this dioecious species. As he points out, the pistillate flowers are borne from spathes in the upper axils that sheathe the base of the long floral tube which elongates and pushes the flower bud to the surface of the water. In the fresh material Woodward observed staminodia, thus demonstrating that *E. canadensis* differs in the morphology of its flowers only in the absence of staminate flowers. The staminate flowers of *E. occidentalis* are tiny globose affairs about 2 mm. long sessile in the middle or lower axils. The staminate spathe encloses the flower tightly, and may be prolonged into a short apiculate tip.

Rydberg distinguished *Philotria Nuttallii* (Planchon) Rydb.,[2] another species which has its floral structure similar to the preceding. It was launched by Planchon as a doubtful species based on *Udora canadensis* Nutt.,[3] excluding the synonym *Elodea canadensis* Michx. Rydberg takes it up for "plants referred to *Elodea canadensis* Michx.,

[1] Rhodora xxi. 218 (1919).
[2] Bull. Torr. Bot. Cl. xxxv. 461 (1908).
[3] Nuttall, Thomas, Gen. N. Am. Pl. ii. 242 (1818).

but with more narrowly oblong, often somewhat acutish leaves. * * * The spathe is like that of *P. angustifolia*, but larger, 5–6 mm. long, the anthers in the unopened flower 2–2.5 mm. long." He had one sheet from New Jersey with staminate and pistillate flowers and other pistillate and sterile plants from New York and Virginia. The writer has seen one sheet, with sessile staminate spathes 5 mm. long, the anthers 2 mm. long, immature pistillate flowers, the leaves narrowly oblong, acutish, much stiffer than those of *occidentalis* and not crowded at the summit of the stem as those of *canadensis*. This tallies exactly with *Nuttallii*, and there are several sheets from a broad range that on their vegetative characters would be put into *Nuttallii*. There are, however, two sheets from southern New England which throw a shadow of doubt on the specific value of the characters of *Nuttallii*. They are *S. N. F. Sanford*, no. 454, in slow stream, Fall River, Massachusetts, August 14, 1913; and *C. A. Weatherby*, no. 3,596, coll. *E. B. Harger & C. A. Weatherby*, shallow water of Housatonic River, Huntington, Connecticut, September 17, 1914. They combine the vegetative characters of *Nuttallii* and the floral characters of *occidentalis*. These will be considered as intermediate specimens and consequently *Nuttallii* as a doubtful species needing further study.

The only other species occurring in New England is *Elodea Planchonii* Caspary. As a matter of fact these four species, all occurring in New England, are, after a study of the specimens in the Gray Herbarium, the Herbarium of the New England Botanical Club, the Herbarium of Brown University, and the private herbaria of Mr. Walter Deane and Mr. C. A. Weatherby, all the species that the writer has been able to recognize in the United States and Canada. He has seen no material to represent *Philotria linearis* Rydb. *Anacharis canadensis* Planchon[1] based on material from Canada: Saskatchewan, *Drummond;* and Canada: *Cleghorn* was reclassified as *Elodea Planchonii* Caspary.[2] There is a good duplicate of the *Drummond* specimen in the Gray Herbarium. The flowers are dioecious, like those of *occidentalis* and *Nuttallii*, but the staminate flowers are remarkably distinct. When young they are sheathed in a spathe which is narrowed to a pedicel-like base. The swollen terminal portion has its upper end open like a wide gaping mouth.

[1] Ann. Sci. Nat. Bot. 3rd ser. xi. 75 (1849).
[2] Pringsheim's Jahrb. wissen. Bot. i. 468 (1858).

In maturing the staminate flower is pushed up to the surface of the water on a long slender thread-like stalk, in the same manner as is the pistillate flower. They have sepals 5 mm. long, and anthers 2.5–4 mm. long. This very distinct plant has recently been redescribed as *Elodea Iowensis* Wylie (*Philotria Iowensis* Wylie),[1] as *Philotria Iowensis* Wylie (*Elodea Iowensis* Wylie),[2] and as *Elodea ioensis* Wylie.[3] Wylie contrasts his species with *E. Planchonii* Caspary, laying emphasis on his new species having the staminate spathe "sessile, contracted at base" instead of as in *Planchonii* having the staminate "Spathe peduncled." This difference exists only in the terminology employed by Wylie and by Rydberg. *E. Planchonii* Caspary was described as having no petals in the staminate flowers. Wylie described and figures[4] *E. ioensis* Wylie as having, in the staminate flowers, linear lanceolate petals, ¼ mm. wide. Examination of a staminate flower from the duplicate type of *E. Planchonii* showed no petals. None of the other material at hand, including Wylie's distribution of *E. ioensis*, showed any petals. It is probable that the petals in the staminate flowers are evanescent, and only to be seen when flowering material is kept under constant observation, as did Wylie with his plant at East Okoboji Lake, Iowa. Comparison of duplicate type material of *Elodea Planchonii* Caspary with authentic and beautifully prepared material of *E. ioensis* Wylie distributed by Wylie himself, proves the two to be identical.

Key to the New England Species of Elodea.

A. Staminate flowers wanting; leaves firm, oblong or ovate-oblong, usually obtuse, crowded and strongly imbricated at the summit of the stem.
1. *E. canadensis* Michx.

A′. Staminate flowers present; leaves linear, lance-linear, lanceolate, or lance-oblong, usually acute, the internodes marked, the leaves divergent, scarcely imbricated even at the summit of the stem.

B. Staminate spathes sessile, the tips not widely divergent; peduncles of staminate flowers not exceeding the spathes, at anthesis breaking and setting free the flowers which float to the surface of the water, sepals not exceeding 2.5 mm. in length, anthers less than 2.5 mm. long.

C. Staminate spathe globose apiculate, the body about 2 mm. long, anthers 0.8–1.1 mm. long; leaves linear, flaccid.
2. *E. occidentalis* (Pursh) St. John.

C′. Staminate spathe lanceolate-ovate, 5–6 mm. long, the anthers 2 mm. long; leaves lance-oblong, firm.
3. *E. Nuttallii* (Planchon) St. John.

[1] Proc. Iowa Acad. Sci. xvii. 82 (1910).
[2] Science n. s. xxxiii. 263 (1911).
[3] Iowa State Univ. Nat. Hist. Bull. vi. 48 (1913).
[4] Iowa State Univ. Nat. Hist. Bull. vi. pl. 2, f. 7 (1913).

B′. Staminate spathe narrowed into a peduncle-like base as long as the expanded body, which ends in a gaping mouth, formed by the deeply cleft tip and the widely divergent points; staminate flowers pushed to the surface of the water by an elongating thread-like pedicel, sepals 4–5 mm. long, anthers 2.5–4 mm. long; leaves lance-oblong.
4. *E. Planchonii* Caspary.

1. Elodea canadensis Michx. Fl. Bor.-Am. i. 20 (1803). *Anacharis Alsinastrum* Bab. Ann. & Mag. Nat. Hist. II. i. 83 (1848), and Ann. Sci. Nat. Bot. 3rd ser. xi. 74 (1849). *Elodea latifolia* Caspary, Pringsheim's Jahrb. wissen. Bot. i. 467 (1858).

Illustrations: Ann. Sci. Nat. Bot. 3rd ser. xi. pl. i. (1849); Bot. Zeit. xvi. pl. ix (1885); Smith, J. E. & Sowerby: English Bot. Supplement pl. 2,993 (1865); Coste, H.: Fl. de France iii. 290 (1906); Britton & Brown: Ill. Fl. ed. 2, i. fig. 248 (1913).

Distribution: Ponds and streams, especially in calcareous areas from Montmorency County, Quebec, south to the mountains of Virginia and Kentucky, and westward to southern Saskatchewan. Quebec: Sainte Anne de Beaupré, Aug. 30, 1905, *J. Macoun*, no. 68,806; Sargent's Bay, Lake Memphremagog, Aug. 3, 1903, *Churchill;* Fitch Bay, Lake Memphremagog, Aug. 18, 1906, *Churchill;* Pickanock River, Aug. 16, 1894, *J. Macoun.* Vermont: Little Otter Creek, Ferrisburg, Aug. 16, 1896, *Eggleston & Grout;* Lake Bomoseen, West Hubbardton, Oct. 3, 1897, *Eggleston;* shore of Winooski River, Essex Junction, July 25, 1911, *S. F. Blake*, no. 2,210. Massachusetts: Andover, Sept., 1883, *Joseph Blake*, no. 963 (508); Lake Quannapowitt, Wakefield, *W. S. Ripley, Jr.*, no. 17,494; shallow water, Lake Garfield, Monterey, July 12, 1912, *R. Hoffmann;* Sheffield, Sept. 25, 1899, *R. Hoffmann.* Rhode Island: Providence, *S. T. Olney.* Connecticut: shallow water about Lake Congamond, Aug. 1–5, 1910, *Eames & Godfrey, Eames*, no. 8,457; Lake Saltonstall, Branford, Sept. 12, 1914, *Blewitt*, no. 1,981; shallow water of Housatonic River, North Canaan, Sept. 6, 1909, *Weatherby*, no. 2,700; shallow water of brook, Huntington, Sept. 17, 1914, *Harger & Weatherby, Weatherby*, no. 3,604; shallow water of Housatonic River, Huntington, Sept. 17, 1914, *Harger & Weatherby, Weatherby*, no. 3,595. New York: still water, Dead Creek, Grass River, Canton, July 18, 1914, *Phelps*, no. 279; western New York, *Gray.* Ontario: Detroit River, Oct. 16, 1861, Herb. *Boott.* Michigan: Manistee, Aug. 17, 1882, *Morong.* Kentucky: [Lexington, cf. Rhodora xv. 120, 1913], *Short.* Illinois: in water 6 dm. deep, Grass Lake, July 28, 1907, *F. C. Gates;* shallow water in a peat-bog lake, Lake Villa, Aug. 8, 1906, *Gleason & Shobe*, no. 182. Minnesota: ponds, Hennepin County, Aug., 1890, *Sandberg;* Garden Island, Lake of the Woods, June 26, 1894, *MacMillan & Sheldon*, no. 572. Saskatchewan: Souris River, July 29, 1883, *J. M. Macoun.*

2. E. **occidentalis** (Pursh) comb. nov. *Serpicula occidentalis* Pursh, excl. syn. *E. canadensis* Michx., Fl. Am. Sept. i. 33 (1814). *Serpicula*

verticillata, *B. angustifolia* Muhl., Cat. Pl. Am. Sept. 84 (1813). *Udora verticillata ? minor* Engelm., publ. in syn., Pringsheim's Jahrb. wissen. Bot. i. 465 (1885). *Philotria minor* (Engelm.) Small, Fl. S. E. U. S. 47 (1903). *Elodea minor* (Engelm.) Farwell, Rep. Mich. Acad. Sci. xvii. 181 (1916).

Illustrations: Britton & Brown: Ill. Fl. ed. 2, i. figs. 249, 251 (1913).

Distribution: In fresh ponds and streams occasionally in brackish waters, avoiding calcareous regions from southern Maine to the District of Columbia, westward to Missouri, northern Wisconsin, Nebraska, and Oregon. Maine: Haley Pond, Rangeley, 1894, *Furbish;* quiet pools in Messalonskee River, Waterville, Sept. 2, 1898, *Chamberlain & Fernald*, *Chamberlain*, no. 774, *Fernald*, no. 2,750; Cobossee Contee Lake, Aug., 1898, *T. J. Battey;* South Poland, 1893, *Furbish;* East Livermore, 1894, *Furbish;* Androscoggin Lake, North Leeds, Sept. 1894, *Furbish;* Lake Auburn, Aug. 1898, *Merrill*, no. 508; tidal pools and rills in mud flats of the river, Bowdoinham, Sept. 19, 1916, *Fernald & Long*, no. 12,448. Vermont: Windsor, July 27–31, 1900, *Eggleston*, no. 2,085. Massachusetts: Lake Cochichewick, North Andover, Sept. 24, 1903, *Pease*, no. 2,638; Somerville, *Warner Bailey;* in shallow water, Spot Pond, Stoneham, Sept. 6, 1912, *C. C. Kingman;* Alewife Brook, Medford, Aug. 21, 1870, *W. Boott;* Fresh Pond, Cambridge, Sept. 21, 1879, *H. A. Young*, Sept. 12, 1886, *Deane*, Sept. 14, 1886, *Deane*, Oct. 1886, *Deane*, *E. & C. E. Faxon*, May 27, 1903, *Pease*, no. 2,063; Muddy River, off Brookline Ave., Brookline, July 1909, *Forbes;* waste lands, Back Bay Fens, Boston, Sept. 17, 1916, *F. S. Collins*, no. 3,639 and Aug. 22, 1917, *F. S. Collins;* sandy bottom, northern end of Mill Pond, Brewster, Aug. 4, 1918, *Fernald*, no. 16,001; Harwich, June 23, 1914, *F. S. Collins*, no. 2,445. Rhode Island: Mill Pond, Lonsdale, Sept. 15, 1888, *A. Greene*. Connecticut: in shallow pools along bank of Connecticut River, Hartford, Sept. 25, 1909, *Blewitt*, no. 609; shallow water of Farmington River, New Hartford, Aug. 17, 1910, *Blewitt*, no. 586; in a slowly flowing stream, Middletown, July 26, 1914, *Ware*, no. 3,472; shallow water of Pistapaug Pond, Durham, Sept. 9, 1913, *Blewitt*, no. 1,680; in shallow pond, Waterbury, Aug. 23, 1911, *Blewitt*, no. 573; in Stony Brook, East Haven, Sept. 12, 1914, *Blewitt*, no. 1,980; fresher waters of Beaver Creek, Milford, July 16, 1897, *E. H. Eames;* stagnant water of a slough, Putnam, Aug. 31, 1915, *Weatherby*, no. 3,777; Boardman's Pond, East Hartford, July 15, 1903, *Weatherby*, no. 367; slow-flowing water of brooks, East Haven, Sept. 12, 1914, *Weatherby*, no. 3,591; shallow water of Pistapaug Pond, Wallingford, Sept. 9, 1913, *Weatherby*, no. 3,373; brackish estuary, Old Lyme, July 8, 1918, *Woodward;* Connecticut River, Hartford, July 18, 1885, *Wright;* Simsbury, Sept. 3, 1904, *I. Holcomb;* Wethersfield, *Wright;* in lacu Bantam prope Litchfield, *D. C. Eaton*. New Jersey: Sussex Co., July 1879, *Rusby*. Pennsylvania: near

Philadelphia, 1848, *James.* Delaware: Wilmington, Herb. *Canby.* Maryland: in open bog, s. 30° w. of Havre de Grace Light, Aug. 1, 1902, *Shull,* no. 147. District of Columbia: in vicinis Washington, June 11, 1882, *Ward.* Wisconsin: Lake Superior, Oronto, July 26, 1868, *Gillman;* Milwaukee, *Lapham.* Illinois: Athens, 1861, *E. Hall,* no. 1,079. Iowa: in water, Fayette, July 1894, *Fink.* Missouri: sloughs, Forest Mill, June 16, 1912, *Palmer,* no. 3,766; St. Louis, May 1845, *Engelmann.* Nebraska: Sweetwater Lakes, Sept. 6, 1915, *Ray Thomson,* no. 177. Kansas: ponds, Linn County, Aug. 9, 1897, *G. L. Clothier;* Fort Leavenworth, 1849, *Fendler.* Oregon: 1871, *E. Hall,* no. 503; Sauvies Islands, Williamette River, 1877, *Howell.*

3. E. **Nuttallii** (Planchon) comb. nov. *Anacharis Nuttallii* Planchon, Pringsheim's Jahrb. wissen. Bot. i. 465 (1858). *Udora canadensis* Nutt. excl. syn. *E. canadensis* Michx. Gen. N. Am. Pl. ii. 242 (1818). *Philotria Nuttallii* (Planchon) Rydb. Bull. Torr. Bot. Cl. xxxv. 461 (1908).

The writer has seen only one flowering specimen that is surely of this species, Connecticut: shallow water of Housatonic River, Oxford, Aug. 13, 1918, *Weatherby,* no. 4,348.

4. E. Planchonii Caspary, Pringsheim's Jahrb. wissen. Bot. i. 468 (1858). *Anacharis canadensis* Planchon, not Michx., Ann. Sci. Nat. Bot. 3rd ser. xi. 75 (1849). *Philotria angustifolia* (Muhl.) Britton, not Britton in Rydb. Fl. Col., Col. Agric. Exp. Sta. Bull. c. 15 (1906). *Philotria Planchonii* (Caspary) Rydb., Bull. Torr. Bot. Cl. xxxv. 462 (1908). *Elodea Iowensis* (*Philotria Iowensis*) Wylie, Proc. Iowa Acad. Sci. xvii. 82 (1910). *Philotria Iowensis* (*Elodea Iowensis*) Wylie, Science. n. s. xxxiii. 263 (1911). *Elodea ioensis* Wylie, Iowa State Univ. Nat. Hist. Bull. vi. 48 (1913).

Distribution: Local in ponds and streams from Massachusetts to Saskatchewan and Colorado. Massachusetts: Great Pond, North Andover, *Sears;* Lake Quannapowitt, July 2 and 14, 1916, *W. S. Ripley, Jr.,* nos. 16,125 and 16,138. New York: western part, *Gray.* Indiana: in the Deshee River about 6 miles west of Decker, Aug. 18, 1919, *Deam,* no. 29,224. Michigan: Fort Gratiot, July 18, 1870, *H. Gillman;* Sault Ste. Marie, July 27, 1873, *H. Gillman.* Wisconsin: Madison, Aug. 14, 1890, *Lapham.* Iowa: East Okoboji Lake, 1911, *Wylie.* North Dakota: in stagnant water, Minot, Aug. 20, 1905, *Lunell.* Saskatchewan: *Drummond.* Wyoming: Fish Hatchery, Sept. 28, 1898, *A. Nelson,* no. 5,374; running water, Seven Mile Lakes, Albany County, Sept. 7, 1901, *Goodding,* no. 597. Colorado: Lee's Lake, Aug. 5, 1897, *Crandall,* no. 2,423.

Gray Herbarium.

THE NORTHERN VARIETY OF RANUNCULUS HISPIDUS.

M. L. Fernald.

Michaux, describing his *Ranunculus hispidus* from "sylvis Carolinae inferioribus," began his description "R. erectus, hirsutissimus."[1] This phrase well characterizes the plant at the southern border of its range, but northward the hirsute plant becomes rare and gradually gives way to a commoner variation with the pubescence appressed or even almost or quite wanting. Thus, of the 38 collections before the writer from New England and New York State 35 have appressed pubescence and only 3 (all from southern Connecticut) have the spreading pubescence of the more southern typical *R. hispidus*. In fact, Dr. K. C. Davis, in his treatment of the genus,[2] apparently wrote from his familiarity with the northern variation, for ignoring the Michaux phrase, "R. erectus, hirsutissimus," Davis described *R. hispidus* as "Appressed-pubescent." From New England and New York the plant with appressed pubescence or subglabrous petioles and stems extends westward to Iowa and south to the mountains of North Carolina, West Virginia, Missouri and Kansas; while typical *R. hispidus* extends well into Georgia and Arkansas. The more northern extreme is worthy varietal separation as

Ranunculus hispidus Michx., var. **falsus**, n. var., petiolis caulibusque sericeo-strigosis vel subglabris.—Vermont and Massachusetts to Ontario and Iowa, south to Virginia, North Carolina, Missouri and Kansas. The following specimens are characteristic. Vermont: rich hillside, Pownal, July 23, 1898, May 30, 1900, *Eggleston*, nos. 108, 1927. Massachusetts: Worcester, May 18, 1912, *Woodward;* moist field, Sturbridge, May 20, 1916, *Knowlton;* damp rocky thicket, Charlton, May 20, 1916, *Bean & Schweinfurth;* Amherst, *Blanchard et al.;* dry woods, Springfield, May 5, 1915, *Andrews;* rich open woods, Stockbridge, May 30, 1902, *Hoffmann;* in humus overlying limestone, Sheffield, May 16, 1907, *Cushman*, no. 517; dry wooded calcareous bank, Sheffield, May 30, 1919, *Bean & Fernald* (type in Gray Herb.). Connecticut: open woods, Franklin, June 6, 1907, *Woodward;* Middlebury, May 5, 1896, *Shepardson;* cold rocky woods, Southington, May 22, 1898, *Bissell;* dry hillside, Waterbury, May 30, 1911, *Blewitt*, no. 684; dry open woods, Salisbury, June 1, 1902, *Fernald.* New York: Westbury, *Tubby;* Harrison, April 25, 1905, *Coe;* open gravelly woods, Lick Brook, Ithaca, May 6, 1915, *Eames*, no. 4064;

[1] Michx. Fl. Bor.-Am. i. 321 (1803).
[2] K. C. Davis, Minn. Bot. Stud. ii. 472 (1900).

gravelly soil, dry open woods, Beebe Lake, Ithaca, August 16, 1915, *Eames & Thomas,* no. 4067; rocky crests above Shurger's Glen, Lansing, May 15, 1916, *MacDaniels & Wiegand,* no. 6447; Lake Chautauqua, June 4, 1893, *Churchill.* NEW JERSEY: Summit, May 23, 1891, *Churchill;* river banks, Camden, June, 1876 (glabrous extreme), *Martindale.* PENNSYLVANIA: West Branch of Octoraro Creek, Lancaster Co., May 6, 1891, *Heller;* near Haines Station, Lancaster Co., May 20, 1901, *Heller.* MARYLAND: Baltimore Co., May 5, 1881, *Smith;* Watersville, May 13, 1881, *Smith.* VIRGINIA: Goshen, Rockbridge Co., May 4, 1915, *Churchill.* WEST VIRGINIA: dry woods, White Sulphur Springs, May 14–17, 1914, *Hunnewell.* NORTH CAROLINA: moist places near Salisbury, Rowan Co., April 22, 1897, *Biltmore Herb.,* no. 1229*b*. ONTARIO: Whirlpool Rapids, Niagara, May, 1901, *J. Macoun,* no. 33,581. OHIO: Toledo, May, 1884, *Young.* INDIANA: without statement of locality or collector. ILLINOIS: rich woods near Cottonwood Station, Urbana, April 17, 1909, *Pease,* no. 11,807; low woods near Crystal Lake, Urbana, April 27, 1909, *Pease,* no. 11,825 (smoother form); Ottawa, *Huett;* moist cleared timberland, Macon Co., May 9, 1915, *Clokey,* no. 2384. WISCONSIN: Preble, Brown Co., May 21, 1892, *Schuette.* IOWA: Marshalltown, May 15, 1897, *Ball,* no. 471; Ames, May 22, 1897, *Ball & Preston,* no. 465. MISSOURI: St. Louis, 1877, *Eggert.* KANSAS: woods, Wyandotte Co., May 3, 1897, *Hitchcock,* no. 1105.

Many of the specimens above cited have been distributed as *R. septentrionalis,* a northern species of swamps and meadows with much coarser stems and leaves and with stout and very long repent stolons developing soon after the expansion of the first flowers.

GRAY HERBARIUM.

HABENARIA PSYCODES, VAR. ECALCARATA IN VERMONT.—Last August there was sent me a peculiar orchid which had been collected by Dr. Anne E. Perkins in a meadow at Berkshire, Vt. Prof. Ames later determined it as the peloric form of *Habenaria psycodes* described, figured and named var. *ecalcarata* by Miss M. M. Bryan.[1]

In this form (for it seems to be a teratological development rather than a true variety) the usual three-parted, spurred and fringed lip is replaced by an oblong-ovate, spurless petal, entire and wholly similar to the other petals, except that it occasionally bears small irregular and jagged marginal projections which remotely suggest its relationship to the normal type of lip. The result is a nearly

[1] Ann. Mo. Bot. Gard. iv. 38 (1917).

regular flower, superficially resembling that of a *Goodyera* much more than that of a *Habenaria* and reminiscent of *H. psycodes* only in color.

Miss Bryan makes no mention of the column in her description of var. *ecalcarata;* in Dr. Perkins's material, however, this organ shares the peloric tendencies of the perianth. Instead of the usual two nearly erect anther-sacs, it develops four, set at various angles in a rough half-circle about its upper part. Presumably the four sacs represent the two anthers of the simpler orchids, such as *Cypripedium*, and their arrangement, like the almost regular perianth, indicates a reversion toward a more primitive and more regular type of flower. All the sacs examined produced pollinia, but these were without distinguishable glands. The whole anterior surface of the column was strongly viscid; but I was unable to determine whether or not the stigma was fully formed and capable of performing its function.

In both Miss Bryan's and Dr. Perkins's material, all the flowers were alike, the peloria not being, as sometimes, confined to a portion of the inflorescence. Miss Bryan's specimens came from Bay View, Mich., where several plants were observed to persist for years: Dr. Perkins noted only one plant at her station. A precisely analogous form of *Habenaria fimbriata* was collected years ago by H. G. Jesup at Lynn, N. H., and described and illustrated by him, but not given a name.[2]—C. A. WEATHERBY, East Hartford, Conn.

POLYGALA PAUCIFOLIA Willd., forma **vestita**, n. f., foliis dense pilosis, pilis canescentibus.

Leaves densely pilose with canescent hairs.—NEW HAMPSHIRE: rich deciduous woods, northwest base of Fall Mountain, Walpole, May 26, 1917, *L. A. Wheeler & M. L. Fernald* (TYPE in Herb. N. E. Bot. Club).

The common form of *Polygala paucifolia* has the leaves green and quite glabrous except for a slight ciliation and sometimes a little pilosity on the midrib. Forma *vestita* is conspicuous when growing on account of its pale foliage and at Walpole forms an extensive carpet.—M. L. FERNALD, Gray Herbarium.

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[2] Bot. Gaz. xviii. 189–190 (1893).